host penetration by the sporidial germ tube of the cereal stem rust fungus. Although ERIKSSON studied sporidial infection in the mallow rust, concluding that penetration is directly through the epidermal cell wall and never through stomata, no careful study of the mechanism of entry of the sporidial germ tube has previously been made. In the present account penetration is shown to result from mechanical action alone, the structures concerned in the process being a mucilaginous investment of the germ tube and a fine style-like infection hypha, originating either from the germ tube or the sporidium directly. The entry of the parasite at first causes no visible alteration of the host cell contents. This manner of parasitic entry, that is, in the absence of visible chemical softening processes of the cuticle, is similar to that previously reported for the infection hypha of *Botrytis* and *Colletotrichum*, and for the zoospore of *Synchytrium* (CURTIS). A new interest is thereby given to studies of disease resistant or disease escaping plants directed toward the mechanical properties of the cuticle and cell wall. Evidence that resistance to infection of potato by *Pythium debaryanum* is of this type has already been presented (HAWKINS and HARVEY); similarly for resistance in the tomato to infection by *Macrosporium tomato* (SANDO and ROSENBAUM).

The question is pertinent whether the resistance or immunity shown by different species of *Berberis* to infection by *Puccinia graminis* is due to mechanical exclusion of the germ tube by a heavy cuticle. There is some evidence that this may be true for the evergreen thick leaved species of *Berberis* generally referred to *Mahonia* or *Odostemon*. Greenhouse inoculations with several forms of *Puccinia graminis* have resulted in infection of very young leaves of *Berberis trifoliolata*, *B. Fremontii*, and the tall form of *B. Aquifolium=Odostemon Nutkanus* (DC) Rydb., although on the last named host only abortive pycnia and no aecia developed. Some other factor appears to be concerned in the immunity of *Berberis Thunbergii* to cereal stem rust, since this plant has soft, thin leaves which lack a well developed cuticle.—FREEMAN WEISS.

Further studies on Tmesipteris.—The life history of the Psilotales is becoming as well known as that of more accessible lycopods through the continued researches of HOLLOWAY,[19] who has published a second paper on the prothallus of *Tmesipteris*, containing additional observations made possible by the finding of more than 200 additional prothallia. *Tmesipteris* and *Psilotum* both have sporelings which resemble their gametophytes. This similarity is not considered by HOLLOWAY as being sufficient evidence for the primitiveness of the Psilotaceae; but he points out that this close correspondence is not found in the life history of other modern Pteridophytes. This resemblance between the two generations, the superficial position of the sex organs, the persistent single apical cell of the prothallus, the dichotomous

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[19] HOLLOWAY, J. E., Further studies on the prothallus, embryo, and young sporophyte of *Tmesipteris*. Trans. New Zealand Inst. **53**:386–422. 1921.

branching, the absence of a primary tubercle, and the lack of differentiated tissue "may all be urged as more or less primitive features." The absence of a suspensor the author thinks may be compensated for by the haustorial protuberances of the foot. The same foot structure, however, also occurs in certain species of *Lycopodium* which do develop a suspensor. The absence of the suspensor is also counted as a primitive feature.

In discussing the significance of its embryogeny, which is "the simplest among existing pteridophytes," the author states: "While not suggesting that *Tmesipteris* has actually been derived from the *Anthoceros* cycle of affinity, it is clear that the absence from the former of any such organs as root or cotyledon suggests that they approximate in so far as they both represent primitive lines of development. That the simplicity of *Tmesipteris* is not due to reduction is a belief which has greatly been strengthened by the discovery of the rootless and leafless Rhyniaceae. The embryogeny of *Tmesipteris* as described in the present paper makes more clear-cut the theory of the origin of the sporophyte of the Pteridophyta from an *Anthoceros*-like sporangium. . . . . The only new feature to be postulated here is the extension in length of the shoot from an apical meristem instead of, as in *Anthoceros*, from an indefinite basal meristem, and the initial cause of the shoot-elongations might be set down as being the adoption of a subterranean mode of life by the gametophyte."—E. A. SPESSARD.

Life cycles of bacteria.—LÖHNIS[20] has published a comprehensive survey of the literature dealing with cell forms of bacteria and their significance in relation to the life history of these organisms. The discussion is amply illustrated with over 40 plates containing nearly 400 figures.

The first section of the monograph contains a discussion of cell forms. The author attempts to refute the monomorphistic doctrine of COHN, KOCH, and their followers. It is shown that many bacteria, possibly all, are pleomorphic, and that the varying cell forms often referred to as "involution" or "degeneration" forms are really different stages in the life cycles of bacteria. It is admitted, however, that our knowledge concerning the relationships of these forms is all too meager.

In the second section reproductive organs are discussed. These are gonidia, regenerative bodies, exospores and endospores, arthrospores, and microcysts. Of these the gonidia and regenerative bodies appear to take the most active part in reproduction, while the other organs may represent resting forms. It is claimed that gonidia are common to all bacteria. The fact that they have not always been observed may be due to their small size and high motility. Regenerative bodies may be of any shape, and are produced either by the vegetative cell or the "symplasm."

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[20] LÖHNIS, F., Studies upon the life cycles of the bacteria. Part I. Review of the literature, 1838–1918. Mem. Nat. Acad. Sci. **16**: Second memoir. pp. 252. *pls. A–S* and *1–23*. 1921.